

## WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

a p-type semiconductor substrate;

an n-type source region and an n-type drain region, both formed in said p-type  
5 semiconductor substrate;

a gate insulating film formed on said p-type semiconductor substrate  
sandwiched between said n-type source region and said n-type drain region;

a first film of n-type Ge semiconductor or n-type SiGe mixed crystal  
semiconductor formed in a layer on said gate insulating film; and

10 a second film of p-type Ge semiconductor or p-type SiGe mixed crystal  
semiconductor formed in a layer on said first film,

said first film and said second film forming a gate electrode.

2. The semiconductor device according to claim 1, wherein

15 said gate electrode further has a metal film formed in a layer on said second  
film.

3. A semiconductor device comprising:

an n-type semiconductor substrate;

20 a p-type source region and a p-type drain region, both formed in said n-type  
semiconductor substrate;

a gate insulating film formed on said n-type semiconductor substrate  
sandwiched between said p-type source region and said p-type drain region;

a first film of p-type Ge semiconductor or p-type SiGe mixed crystal  
25 semiconductor formed in a layer on said gate insulating film; and

a second film of n-type Ge semiconductor or n-type SiGe mixed crystal semiconductor formed in a layer on said first film,

said first film and said second film forming a gate electrode.

5           4. The semiconductor device according to claim 3, wherein  
said gate electrode further has a metal film formed in a layer on said second film.

10           5. A semiconductor device comprising:  
an n-channel transistor; and  
a p-channel transistor,  
said n-channel transistor comprising:  
a p-type semiconductor substrate;  
an n-type source region and an n-type drain region, both formed in said p-type  
15 semiconductor substrate;

a gate insulating film formed on said p-type semiconductor substrate sandwiched between said n-type source region and said n-type drain region;

a first film of n-type Ge semiconductor or n-type SiGe mixed crystal semiconductor formed in a layer on said gate insulating film; and

20           a second film of p-type Ge semiconductor or p-type SiGe mixed crystal semiconductor formed in a layer on said first film,

said first film and said second film forming a gate electrode of said n-channel transistor,

25           said p-channel transistor comprising:  
an n-type semiconductor substrate;

a p-type source region and a p-type drain region, both formed in said n-type semiconductor substrate;

a gate insulating film formed on said n-type semiconductor substrate sandwiched between said p-type source region and said p-type drain region;

5        a third film of p-type Ge semiconductor or p-type SiGe mixed crystal semiconductor formed in a layer on said gate insulating film; and

a fourth film of n-type Ge semiconductor or n-type SiGe mixed crystal semiconductor formed in a layer on said third film,

10        said third film and said fourth film forming a gate electrode of said p-channel transistor,

said n-channel transistor and said p-channel transistor constituting a CMOS transistor.

6. The semiconductor device according to claim 5, wherein

15        said gate electrode of said n-channel transistor further has a first metal film formed in a layer on said second film,

said gate electrode of said p-channel transistor further has a second metal film formed in a layer on said fourth film.